MOBILITY & PRODUCTION

Fields of Expertise TU Graz

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Peter Fischer
Source: Lunghammer – TU Graz

Mobility & Production

The recent call for the tenure-track professorship in Mobility & Production with focus on Metrology and Instrumentation attracted 40 international applications, of which the five most promising candidates were invited for hearings.

The candidates provided fascinating insights into their research in the field of sensor technology and environmental monitoring with the major goal of reducing emissions via monitoring emissions from mobile applications.

This tenure-track position will play a key role in strengthening the core research area at the interface between environmental technology, mobility and production. For several years, TU Graz has built up a high international visibility in the research area of non-exhaust particle emissions, which typically derive from tire, brake and road wear. Several research groups at TU Graz are working on better understanding the formation and properties of non-exhaust particles, developing reduction measures and contributing to international regulations for limitation of these particles.

One of these focus areas is tire emissions. While tire abrasion particles are very small, their total mass in the world oceans equals or even surpasses that of all microplastics from industry, commerce and households combined. In Austria, around 21,000 tons of tire abrasion are produced every year. This corresponds to approx. 950 fully-loaded semi-trailer trucks. Roughly 90% to 95% of the tire-microplastic mass is deposited on the roads and roadsides. A considerable proportion of it is subsequently washed out. The washed-out particles then mainly take two routes. The first route leads via bodies of water directly to the “ocean – the final site of disposal” and into the food chain. The second route leads via wastewater treatment plants of sewage sludge, to agricultural fertilizers and also into the food chain.

Between 5% and 10% of tire abrasion are airborne particles smaller than 10 micrometers. These are technical waste products of tiny size, which otherwise hardly occur in nature. By comparison, pollen is an order of magnitude larger, around 10 to 100 micrometers. Airborne particles of approx. 1 micrometer reach the deepest alveoli of the lungs and are deposited there. Particles smaller than approx. 0.4 micrometers penetrate through the lungs into the blood and accumulate in organs such as the liver, kidneys or heart. Particles smaller than approx. 0.1 micrometers cross the blood-brain barrier and accumulate in the brain. Depending on where they are deposited and their toxicity, the particles aggravate or cause lung diseases, cardiovascular diseases, internal inflammation, Alzheimer’s, Parkinson’s and other neural defects.

On average, each person ingests around 5 grams of microplastics per week through food and the air we breathe. A young person aged 20 has already ingested around 5 kg of plastic. A large proportion of this mass leaves the body again. Airborne microplastics which reach the blood, organs and brain find their final repository there. However, microplastic particles may be classified as relatively harmless compared to other technical abrasions. Nanoparticles from brakes can contain critical toxic substances such as copper oxides, antimony trisulphides, chromium, cadmium, sulphur and several more. Mercury and lead have also been found in aftermarket brake pads!

For all TU Graz research teams working on non-exhaust particles we wish success of all kinds – not just for scientific advancement but for the health and well-being of us all.